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(57) Abstract

An image-receiving medium comprising in one embodiment a paper substrate having a basis weight of at least 50lb/3000ft^2, and an internal sizing of at least 250s (Hercules test); a backcoat layer on one surface of the substrate comprising an anticurling agent and paper handling aid; a sealing basecoat layer on the other surface of the substrate; and an ink-receiving topcoat layer on the basecoat layer, the topcoat layer having an ink absorptivity of at least 200 %. The media provide glossy, photographic quality images with ink jet printers.

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GLOSSY INK JET PAPER

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application No. 60/047,486, filed May 23, 1997, and U.S. Patent Application No. 08/949,601, filed October 14, 1997, of which the disclosures are incorporated herein by reference.

BACKGROUND OF THE INVENTION

This invention relates to image-receiving media, and, in particular, to coated papers which can receive and display high quality, glossy, ink jet images.

Image-receiving media for, e.g., ink jet output have received increasing attention as the quality of ink jet "engines" has improved. Where once simple high-quality uncoated paper would have sufficed to present images output from, e.g., 300 dpi printers, resolutions of 720 dpi are now commonplace, and 1400 dpi and higher images are placing greater demands on image-receiving media.

Ink-receiving media suitable for ink jet applications must be able to accept the ink ejected from the print head so that the ink is absorbed by the medium without undue spreading of the image. Further desirable attributes include relatively rapid drying of the ink-based image without cockling of the medium, i.e., paper; water fastness of the image when water based inks are used; proper paper handling (i.e., block resistance); and durability (i.e., pick resistance). Most importantly, an aesthetically pleasing image should be obtained. Printed images judged as "high-quality" usually have a glossy surface appearance image. Users of ink-jet printers, however, have not been able to get the best-looking output due to a lack of suitable printing substrates. Glossy papers are available but do not provide the attributes noted above, and furthermore tend to absorb the ink carrier unevenly, cockling or rippling the paper surface. Even very fine cockling can result in image degradation due to the even glossy sheen of the paper coated being disturbed by the rippling of the paper. The image degradation appears to be due to irregular light scattering off the rippled surface, as compared to the more desirable situation of ordered reflection of light rays off

of a smooth surface. Also, many papers available today also fail to offer a requisite whiteness important in optimizing the color gamut (the range of reproducible colors).

It is therefore an objective of the present invention to provide a ink-receiving medium that provide photographic-quality images with high gloss to enhance the image quality; and that can accept the ink-bearing image without cockling or curling the paper substrate and degrading the image.

SUMMARY OF THE INVENTION

The image-receiving media disclosed herein comprise a substrate on which a backcoat is applied on one side, and, in order, a sealing basecoat, and topcoat layer on the other, image-receiving side. The invention further relates in one embodiment to an image-receiving medium comprising a paper substrate having a basis weight of at least 50lb/3000ft^2, and an internal sizing of at least 250s (Hercules test); a backcoat layer on one surface of the substrate comprising an anticurling agent and paper handling aid; a sealing basecoat layer on the other surface of the substrate; and an ink-receiving topcoat layer on the basecoat layer, the topcoat layer desirably having an ink absorptivity of at least 200%.

DESCRIPTION OF THE DRAWINGS

Fig. 1 is a reproduction of the Wasatch Basic Media Acceptance test pattern used for determining ink absorptivity.

DESCRIPTION OF THE INVENTION

The image-receiving media disclosed herein comprise a substrate on which a backcoat is applied on one side, (the non-image receiving side), and, in order, a sealing basecoat, and topcoat layer on the other, image-receiving side. Other layers are possible, but these are the essential elements of the media disclosed herein.

The substrate is a paper having a basis weight of at least 50lb/3000ft^2, preferably in the range of 50 to 80lb (per 3000ft^2). The substrate should also have an internal sizing of at least 250s (Hercules test). The degree of sizing is important for obtaining good coating performance of the various layers of the media of the invention, particularly to obtain an even glossy sheen on the paper.

The backcoat layer comprises an anticurling agent to preserve the dimensional integrity of the paper upon receipt of an ink-jet image, i.e., the undesirable degradation of the gloss or satin finish caused by subtle rippling in the due to ink absorption effectively is eliminated. Suitable

anticurling agents include acrylic vinyl acetates such as SUNCRYL 129 (Sequa Chemicals). This layer may desirably contain other additives, particularly those which aid in sheet feeding and handling. Such additives include fluoropolymers such as SCOTCHBAN FC-829 (3M) for antiblocking, and non-water soluble wheat starch for improved paper feeding, the latter additive apparently acting as a spacer to provide air gaps between each sheet, to aid in paper feeding. The inclusion of the wheat starch in the backcoat also allows the user to determine by touch the printing from the non-printing side, since the starch in the backcoat imparts a slightly rough or nubby feel.

The sealing basecoat layer is applied to the other (image-receiving) side of the substrate, and serves two primary purposes: 1) to substantially contribute to the gloss or sheen of the paper, in combination with the topcoat layer; and 2) to seal the paper substrate to prevent ink penetration from the topcoat layer and preserve the dimensional integrity of the paper, and, in turn, protect the aesthetic quality provided by the gloss finish.

It is desirable that the basecoat have moisture vapor transmission (MVT) of less than about 75g $H_20/m^2/24$ hour period, preferably less than about 60, as determined by ASTM E96-94, the text of which is incorporated herein by reference. Coatings which bond well to the paper and provide the necessary sealing function may be used, such as polyurethanes; styrene/acrylic copolymers; polyethylenes; polypropylenes; polyvinylalcohols; polyesters; and mixtures thereof. For example, the major component of the sealing basecoat may comprise styrene-acrylic copolymer coating materials like SEQUABOND 7880 (Sequa), in sufficient concentration to provide the necessary impermeability. SEQUABOND 7880 has an MVT of about 50.

The topcoat layer serves as the ink-absorbing layer, and enhances the gloss or sheen provided by the basecoat. The topcoat layer should have an ink absorptivity of at least 200%, preferably 250%, and more preferably 300%. "Ink absorptivity" of the topcoat layer, as the term is used herein, is determined as follows. A paper bearing an ink-receiving layer to be tested for ink absorptivity is loaded into an Encad Novajet Pro® wide format printer loaded with black, yellow, cyan and magenta inks, e.g., Tru-Color ULTRA VR-12 inks (Sentinel Imaging (Greenland, New Hampshire)). The Encad printer is connected to a personal computer running Wasatch PosterMaker V3.2 software, with the PostScript file media.ps, included with the Wasatch software, loaded. The test printing pattern generated by media.ps is depicted in Fig. 1. The array of "full-color" black squares on the right hand side of the figure are generated by (from

right to left) gradually increasing ink out put. The test pattern is sent to the printer and inspected immediately after completion of printing. Visual inspection of each of square is made, to detect whether pooling or incomplete drying of the ink has taken place. Ink absorptivity is deemed complete when no pooling or wet ink is detected. Therefore, for example, if the square with the 250 legend next to it is wet but the square with the 200 legend is dry, that paper has an ink absorptivity of 200%.

Papers comprising the top coat layer described herein desirably have a gloss value of about 20 to 98 percent at an angle of 60°, as determined by the Byke-Gardner Spectrophotometer 9000. The constituents of the topcoat layer may comprise, for example, polyvinylpyrrolidone (PVP) and copolymers thereof such as PVP/vinyl acetate (VAc); alkylcelluloses like carboxymethylcellulose; and gelatins. Monocomponent or multicomponent mixtures of the above may also be used. In particular, it has been found that addition of alkylcelluloses like carboxymethylcellulose in varying amounts imparts beneficial properties such as improved drying time and better ink acceptance, to the topcoat. Increasing or decreasing the relative amount of the alkylcellulose in the topcoat has also been found to decrease or increase, respectively, the gloss values obtained. The alkylcellulose component may be added advantageously from 20 to 80 parts by weight (based on the total in the topcoat), preferably from 40 to 60.

Another aspect of the invention relates to the discovery of an ink-receiving layers comprising a fish gelatin, and ink-receiving substrates comprising such ink-receiving layers. The novel ink-receiving layers containing fish gelatin exhibit very good gloss. Modified fish gelatin, having lower amounts of proline and hydroxyproline, has been found particularly advantageous. These amino acids contribute to hydrogen bonding in the gelatin, and their lower concentration in modified fish gelatin is believed to allow water solutions of modified fish gelatin to remain liquid at room temperature, even a high concentrations. Advantageously, therefore, solution from which the novel ink-receiving layers are made may be coated at lower coating temperatures, i.e., room temperature as well, particularly when compared to animal-sourced gelatins. This is advantageous since this avoids the expense and trouble of having to control the temperature of the topcoat solution during the coating operation.

A particularly advantageous embodiment of the above ink-receiving layer comprises modified fish gelatin as noted above and an alkylcellulose, in a weight ratio of from about 4:1 to

0.5:1, preferably between 3:1 and 0.5:1. Preferably the fish gelatin is a modified fish gelatin as noted above.

Additional components may be added to the topcoat if desired. For example, addition of a crosslinker has been found to enhance topcoat adhesion with crosslinkable topcoat constituents such as PVP and copolymers thereof, particularly if the basecoat contains the same crosslinkable top coat constituent.

In another embodiment, colloidal silica may also be desirably added to the topcoat. Colloidal silica may be desirably added in an amount of from about 5 to 50 parts by (dry) weight of the top coat composition. The particle size of the silica is desirably less than 200nm, more desirably less than 100nm; preferably between 1 and 50nm, more preferably between 1 and 25nm, even more preferably between 1 and 20nm, and most preferably between 1 and 15nm. Addition of colloidal silica has been found to control the dot gain of the printed image, and also aids in speeding up the drying time of the printed image. When adding the colloidal silica it has been found that, to obtain the beneficial effect of the silica addition, pH control of the coating solution is important for ensuring that the silica remains in suspension and does not agglomerate or floc out. Controlling the pH of the coating solution to a range of about 5.0 to 9.0 has been found to work well.

The following examples further demonstrate the invention. All parts are by weight unless otherwise indicated.

EXAMPLE 1

An image receiving medium in accordance with the disclosure was made as follows. A Westvaco litho paper (Hi-Brite CIS Sterling Litho) with a basis weight of 118 gsm (80 lb/3000 ft^2), caliper of 4.3 mil, PPS (H/10) @2. 0m. H_20 of about 1.2 Tm, L=96.2, a=0.9, and b=0.8, was coated with a basecoat. The basecoat was an aqueous dispersion of Sequabond 7880 (42% solids) (Sequa) which was diluted with water to 35% solids before coating. The paper was coated at a coating weight of 6 lb/ream, using a #18 Meyer rod, and subsequently dried.

A backcoat solution was prepared by dissolving 0.5g of CMC-7H sodium salt of carboxymethyl cellulose (Hercules) in water, then adding 84g MWS 100F classified deproteinized wheat starch (Midwest Solvents), and mixing for 30 min. This dispersion was added to 336g of Suncryl 129 dispersion and mixed in a homogenizer for 30 min. Water was added to provide a

final coating solids of 42%. The coating solution was applied at 6 lb/ream to the uncoated side of the paper above using a #18 Meyer rod, followed by drying of the paper.

A topcoat solution was prepared by adding 24.7g water to 18.89 W-735 (50% solids) polyvinyl pyrrolidone (PVP)/vinyl acetate (VA) copolymer solution (ISP) under agitation and mixing, for 15 min. 19.2g of Carboset GA1086 styrene-acrylic copolymer emulsion (BF Goodrich) was slowly poured into the solution under agitation and further mixed for 30 minutes. Then two drops of Dynol 604 ethoxylated acetylenic diol (Air Products) was added, followed by an additional 30 minutes of mixing. This coating was applied to the basecoat of 8 lb/ream using #44 Meyer rod, followed by drying of the paper.

High resolution color images were printed on this paper. The paper fed through the printer quite well, and glossy, high quality images were obtained.

EXAMPLE 2

Another image receiving medium in accordance with the disclosure was made as follows. A Champion paper (Hi-Brite CIS Sterling Litho) with a basis weight of 118 gsm (80 lb/3000 ft^2), an internal sizing of at least 250s, caliper of 4.3 mil, PPS (H/10) @ 2.0m H_20 of about 1.2 Tm, L=96.2, a=0.9, and b=0.8, was coated with a basecoat. The basecoat was Suncryl 129 (neat). The paper was coated with the basecoat solution at a coating weight of 10lb/ream, using a #18 Meyer rod, then the paper was dried.

A backcoat solution was prepared by adding 350g of Scotchban FC-829 fluoropolymer (3M) to 4000g of Suncryl 129 dispersion followed by mixing for 30 min. Water was added to provide a final coating solids of 38%. The coating solution was applied at 10lb/ream to the uncoated side of the paper above using a #18 Meyer rod, followed by drying of the paper.

A topcoat solution was made. A 20% solution of Luviskol K90 PVP (ISP) was prepared by dissolving the K90 in heated water (about 191°F) while mixing for at least one hour. A 45% solution of Luviskol K17 PVP (ISP) was made in generally the same manner. This K17 solution was added to the K90 solution in a solids ratio of 6 parts by solid weight K17 to 4 parts by solid weight K90 and mixed, then a styrene acrylic emulsion, Neocryl A-1052 (Zeneca), was added to the above solution in a solids ratio of 1:1 and mixed. Finally, a wetting agent, Dynol 604 (Air Products) was added to the mixture at 0.15% of the total solids. Sufficient water was added to the mixture to bring the total solids to 15%. This coating was applied to the basecoat of 8 lb/ream using a #44 Meyer rod, followed by drying of the paper.

High resolution color images were printed on this paper. The paper fed through the printer quite well, and glossy, high quality images were obtained.

EXAMPLE 3

Papers were made as in Example 1 but with the further addition of 2-20 parts in CMC 9LV, a carboxymethylcellulose (Hercules), in the paper topcoat composition. In addition to obtaining high quality ink-jet images, it was found that black ink wetting and drying time was improved.

EXAMPLE 4

A high gloss finish image receiving medium in accordance with the disclosure was made as follows. A backcoat/basecoat coated paper was prepared as in Example 2.

A topcoat solution was made. 79.8 parts modified fish gelatin (Norland Products, Inc.) was mixed with sufficient water to provide a 20% solids solution. To this was added a 10% solids solution containing 19.5 parts CMC (MetsaSerla/Aqualon), as mixing continued. Finally, 0.25 parts of Triton X-100 were added, and water was added to result in a solids concentration of 10% to 20%.

This coating was applied to the basecoat of 8 lb/ream using a #60 Meyer rod, followed by drying of the paper. Measured gloss was 80°.

High resolution color images were printed on this paper. The paper fed through the printer quite well, and glossy high quality images were obtained.

EXAMPLE 5

An image-receiving medium in accordance with the disclosure was made as follows. A backcoat/basecoat coated paper was prepared as in Example 2.

A topcoat solution was made. 63.81 parts modified fish gelatin (Norland Products, Inc.) was mixed with sufficient water to provide a 20% solids solution. To this was added a 20% solids solution containing 15.95 parts CMC (Metsa-Serla/Aqualon), as mixing continued. A 20% solids dispersion of colloidal silica, containing 19.94 parts silica (Grace Davison, average particle size 15µ) was added slowly under high agitation to the mixture to prevent agglomeration. Finally, 0.3 parts of Triton X-100 were added, and water was added to result in a solids concentration of 10% to 20%.

This coating was applied to the basecoat of 8 lb/ream using a #60 Meyer rod, followed by drying of the paper. Measured loss was 7°.

High resolution color images were printed on this paper. The paper fed through the printer quite well and high quality images (with a matte finish) were obtained.

EXAMPLE 6

An image receiving medium in accordance with the disclosure was made as follows. A backcoat/basecoat coated paper was prepared as in Example 2.

A topcoat solution was made. 64.78 parts modified fish gelatin (Norland Products, Inc.) was mixed with sufficient water to provide a 20% solids solution. To this was added a 10% solids solution containing 16.19 parts CMC (Metsa-Serla/Aqualon), as mixing continued. A 20% solids solution containing 4.05 parts styrene-acrylic copolymer (Carboset GA1086) was added and mixing continued. A 20% solids dispersion of colloidal silica, containing 14.98 parts silica (Snotex-40, Nissan Chemical, particle size range 10-20nm) was added slowly under high agitation to the mixture to prevent agglomeration. Finally, 0.3 parts of Triton X-100 were added, and water was added to result in a solids concentration of 10% to 20%.

This coating was applied to the basecoat of 8 lb/ream using a #60 Meyer rod, followed by drying of the paper. Measured gloss was 80°.

High resolution color images were printed on this paper. The paper fed through the printer quite well, and glossy, high quality images were obtained.

EXAMPLE 7

A high gloss finish image receiving medium in accordance with the disclosure was made as follows. A backcoat/basecoat coated paper was prepared as in Example 2.

A topcoat solution was made. 59.55 parts modified fish gelatin (Norland Products, Inc.) was mixed with sufficient water to provide a 20% solids solution. To this was added a 20% solids solution containing 28.08 parts of Finnfix 2G CMC (Metsa-Serla/Aqualon), as mixing continued. A 20% solids dispersion of colloidal silica, containing 12.37 parts silica (Ludox SK, average particle size 10nm (DuPont Specialty Chemicals)) was added slowly under high agitation to the mixture to prevent agglomeration. Finally, 10% NH_4OH was added to adjust the pH to 8.5, and water was added to result in a solids concentration of 10% to 20%.

This coating was applied to the basecoat of 8 lb/ream using a #60 Meyer rod, followed by drying of the paper. Measured gloss was 80°.

High resolution color images were printed on this paper. The paper fed through the printer quite well, and glossy, high quality images were obtained.

EXAMPLE 8

A satin finish image receiving medium in accordance with the disclosure was made as follows. A backcoat/basecoat coated paper was prepared as in Example 2.

A topcoat solution was made. 38.12 parts modified fish gelatin (Norland Products, Inc.) was mixed with sufficient water to provide a 20% solids solution. To this was added a 10% solids solution containing 46.57 parts of Finnfix 2G CMC, as mixing continued. A 20% solids dispersion of colloidal silica, containing 14.95 parts silica (Ludox SK) was added slowly under high agitation to the mixture to prevent agglomeration. Finally, 0.36 parts of Triton X-100 was added, and water was added to result in a solids concentration of 10% to 20%.

This coating was applied to the basecoat of 8 lb/ream using a #60 Meyer rod, followed by drying of the paper. Measured gloss was 20°.

High resolution color images were printed on this paper. The paper fed through the printer quite well, and satiny, high quality images were obtained.

It should be noted that other embodiments and variations of the invention will be apparent to those of ordinary skill in the art without departing from the inventive concepts contained herein. Accordingly, the invention should not be viewed as limited except as by the scope and spirit of the appended claims.

CLAIMS

What is claimed is:

1. An image-receiving medium comprising

   a. a paper substrate having a basis weight of at least $50lb/3000ft^2$, and an internal sizing of at least 250s (Hercules test);

   b. a backcoat layer on one surface of said substrate comprising an anticurling agent and paper handling aid;

   c. a sealing basecoat layer on the other surface of said substrate; and

   d. an ink-receiving topcoat layer on said basecoat layer.

2. The image-receiving medium of claim 1, wherein said topcoat layer having an ink absorptivity of at least 200%.

3. The image-receiving medium of claim 1, wherein said topcoat layer having an ink absorptivity of at least 250%.

4. The image-receiving medium of claim 1, wherein said topcoat layer having an ink absorptivity of at least 300%.

5. The image-receiving medium of claim 1, wherein said basecoat has a moisture vapor transmission of less than about 75g $H_20/M^2/24$ hour period.

6. The image-receiving medium of claim 1, wherein said basecoat has a moisture vapor transmission of less than about 60g $H_20/m^2/24$ hour period.

7. The image-receiving medium of claim 1, wherein said ink-receiving topcoat layer comprises polyvinylpyrrolidone (PVP) and copolymers thereof; alkylcelluloses; gelatin; styrene-acrylic copolymer; and mixtures thereof.

8. The image-receiving medium of claim 1 wherein said ink-receiving topcoat layer has a gloss value of between about 20 to 98 percent at an angle of 60°.

9. The image-receiving medium of claim 1 wherein said ink-receiving topcoat layer comprises fish gelatin and alkylcellulose.

10. The image-receiving medium of claim 9 wherein said fish gelatin and alkylcellulose are present in a ratio of from about 3:1 to 0.5:1.

11. The image-receiving medium of claim 1 wherein said ink-receiving topcoat layer comprises alkylcellulose in a range of about 20 to 80 parts by weight (based on the total in said topcoat).

12. The image-receiving medium of claim 1 wherein said ink-receiving topcoat layer comprises alkylcellulose in a range of about 40 to 60 parts by weight (based on the total in said topcoat).

13. The image-receiving medium of claim 1 wherein said ink-receiving topcoat layer comprises colloidal silica in a range of from 5 to 50 parts by (dry) weight of the top coat composition.

14. The image-receiving medium of claim 13 wherein said colloidal silica has a particle size of less than 200nm.

15. The image-receiving medium of claim 13 wherein said colloidal silica has a particle size of less than 100nm.

16. The image-receiving medium of claim 13 wherein said colloidal silica has a particle size of from about 1nm to 50nm

17. The image-receiving medium of claim 13 wherein said colloidal silica has a particle size of from about 1nm to 25nm.

18. The image-receiving medium of claim 13 wherein said colloidal silica has a particle size of from about 1nm to 20 nm.

19. The image-receiving medium of claim 1 wherein said paper-handling aid is a non-water soluble wheat starch.

20. The image-receiving medium of claim 1 wherein said backcoat layer further comprises an antiblocking agent.

21. The image-receiving medium of claim 20 wherein said antiblocking agent is a fluoropolymer.

22. The image-receiving medium of claim 1 wherein said basecoat comprises polyurethane; styrene/acrylic copolymers; polyethylenes; polypropylenes; polyvinylalcohols; polyesters; and mixtures thereof.

23. The image-receiving medium of claim 1 wherein said backcoat comprises a acrylic vinyl acetate.

24. The image-receiving medium of claim 1 wherein said topcoat comprises a styrene-acrylic copolymer.

25. An ink-receiving coating composition comprising fish gelatin.

26. The ink-receiving coating composition of claim 25 further comprising alkylcellulose.

27. The ink-receiving coating composition of claim 26 wherein said alkylcellulose is carboxymethylcellulose.

28. The ink-receiving coating composition of claim 26 wherein said fish gelatin and alkylcellulose are present in a ratio of from about 3:1 to 0.5:1.

29. The ink-receiving coating composition of claim 26 further comprising colloidal silica in a range of from 5 to 50 parts by (dry) weight of the top coat composition.

30. The ink-receiving coating composition of claim 29 wherein said colloidal silica has a particle size of less than 200nm.

31. The ink-receiving coating composition of claim 29 wherein said colloidal silica has a particle size of less than 100nm.

32. The ink-receiving coating composition of claim 29 wherein said colloidal silica has a particle size of from about lnm to 50nm.

33. The ink-receiving coating composition of claim 29 wherein said colloidal silica has a particle size of from about 1nm to 25nm.

34. The ink-receiving coating composition of claim 29 wherein said colloidal silica has a particle size of from about 1nm to 20nm.

35. The ink-receiving coating composition of claim 25 wherein said fish gelatin is a modified fish gelatin having lower amounts of proline and hydroxyproline.

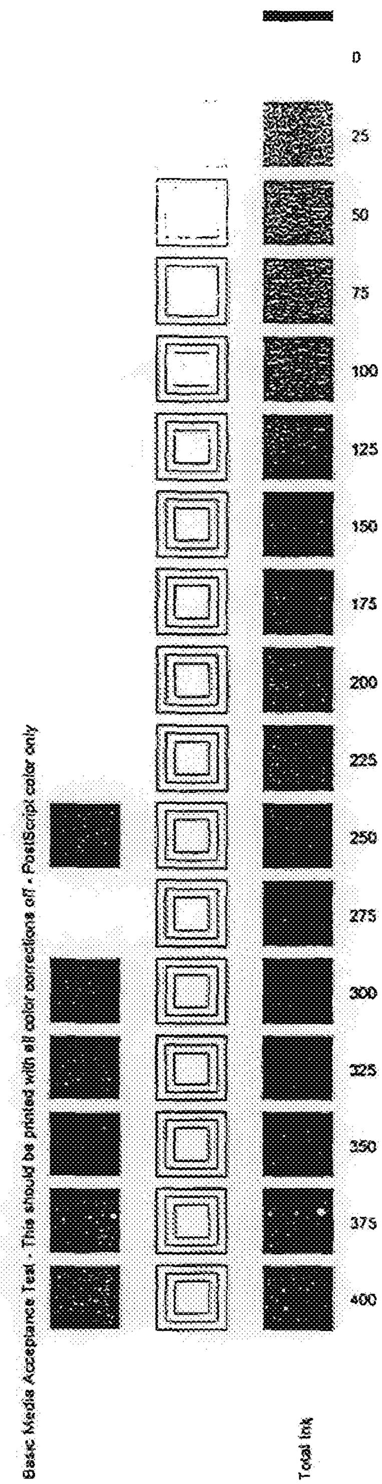
Basic Media Acceptance Test - This should be printed with all color corrections off - PostScript color only
Total Ink
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
375
400

Figure 1

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 98/10343

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B41M5/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B41M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 737 592 A (MITSUBISHI PAPER MILLS LTD) 16 October 1996 see page 7, line 52 - line 59 see page 8, line 17 - line 21 see page 8, line 40 - line 44 see page 9, line 18 - line 34 ---	1,7, 11-13, 20,22,24
X	EP 0 452 121 A (OJI PAPER CO) 16 October 1991 see page 4, line 31 - line 54 see claims 1,7 see the whole document ---	1,20,22
A	EP 0 764 546 A (SCHOELLER FELIX JUN FOTO) 26 March 1997 see page 4, line 40 - line 50 see the whole document --- -/--	1-24

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
12 August 1998	25/08/1998

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International Application No
PCT/US 98/10343

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